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Getting innovations from fieldwork

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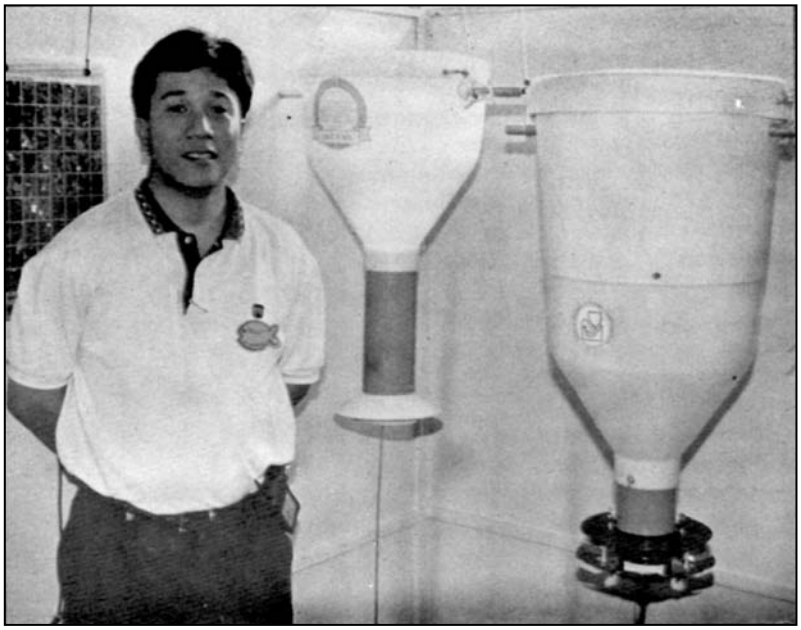
Getting innovations from fieldwork

By **MB Surtida**

On March 19, 1997, Philip S. Cruz, 32, won the National Grand Prize of the first Department of Science and Technology competition on industry and energy research. He has invented and patented the Kinetic Feeder™ for milkfish and tilapia. The grand prize carried with it a cash bonus of ₱100,000.

"This award will definitely help a lot in my R&D activities, "says Philip. He has read papers in many international and national conferences mostly on feeds and feeding management, and is also the author of the book Shrimp Feeding Management: Principles and Practices. He is a member of several professional organizations, and the founding president of U.P. Aquaculture Society, Inc.

Philip is the patent owner and applicant of various fish feeding equipments for aquaculture.



What inspired you towards inventing the Kinetic Feeder?

I was technical services manager of a shrimp feed company for nearly five years. When the shrimp industry crashed, we shifted to fish feeds. Feeding then was done mainly with the use of the feeding tray (sinking feeds), floating frame (floating feeds), or by hand feeding. I realized that the tray was not an appropriate feeding method for fish, there is just too much wastage from pellet disintegration and nutrient leaching. As for the floating frame, this actually limited feeding area to the surface and downwind and this often caused problems on uneven fish sizes. Hand feeding is effective, but when you compute the cost, it is expensive. With these constraints, I saw the challenge to try to develop a feeding device designed for the local fish farming industry.

What is the concept of your feeder?

It is a demand feeder. It releases feeds only when an actuator or "bait" rod is moved by the fish. This concept is not really new. Demand feeders have been in use in Europe and US for more than 20 years. But ironically, despite the Philippines being progressive in aquaculture, we have never successfully adopted such a valuable device. The problem basically was that there was no appropriate design suited to the feeding behavior of local species as well as to local farming conditions.

How about the foreign designed ones?

When I was still with the feed company, we imported a demand feeder from the US. We tried it on milkfish and tilapia but I wasn't satisfied. The device was eventually abandoned. When I started my own business, I did my own R&D on the feeder. After two years, I was able to make many important improvements, making the product a breakthrough in fish feeding management. The judges in the recent DOST national competition found my work novel and significant (please see cross sectional view and caption) and decided to give me the award.

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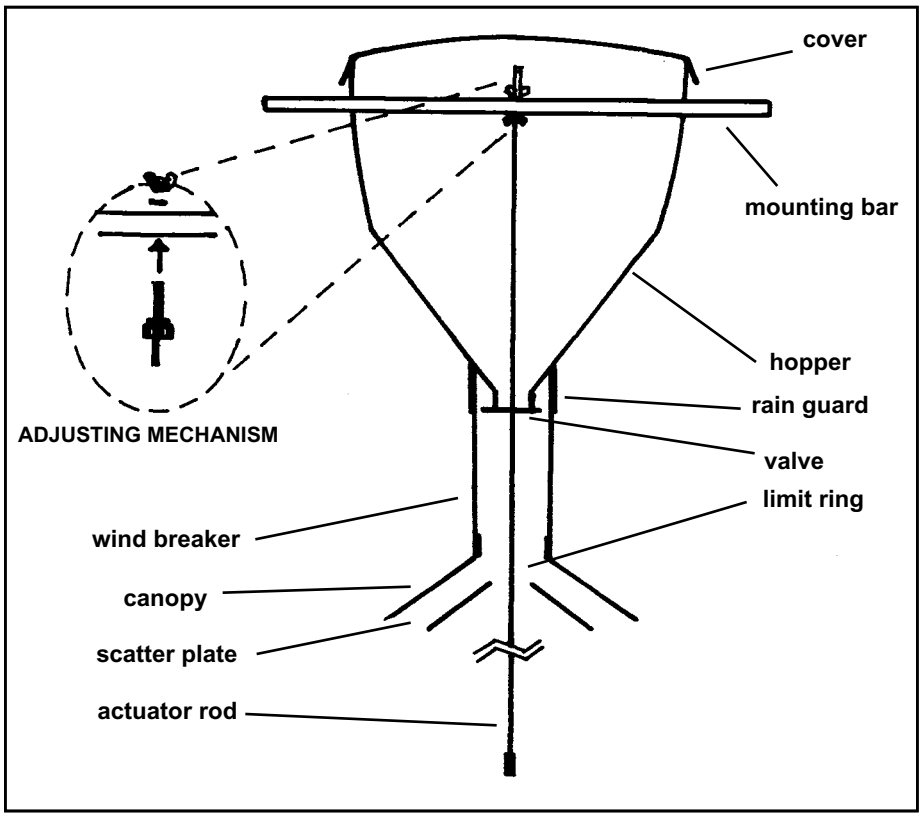

After numerous experimentations for the design of the kinetic feeder, Philip's efforts produced several important and novel improvements. These are the redesign of the valve, addition of a limit ring, addition of scatter plate, addition of wind breaker, optimization of the hopper size, and optimization of the design for transport and storage. A cross sectional view of the kinetic feeder is shown.

What are the improvements introduced by your Kinetic Feeder?

Because feeding is on demand, overfeeding or underfeeding is prevented. Second, feed pellets are immediately consumed as these drop in the water. There is thus no chance for the pellet to disintegrate and for the soluble nutrients to leach out. Pollution, in effect, is minimized allowing better water quality. With the patented scatter plate, one unit of the Kinetic Feeder is able to effectively feed 1,500-2,000 fish. These factors lead to improved growth and feed conversion, and more uniform fish sizes. Also worth mentioning is the savings on labor with the use of the feeder.

As an inventor, how would you reconcile both disciplines as a scientist (you have an MS degree) and as an entrepreneur?

When I do my R&D, I tackle a problem from the point of view of the farmer. It actually demands one to be more creative. In developing the Kinetic Feeder, making it work was just half of the problem. I had to make the product affordable yet durable, simple yet efficient, easily disassembled and assembled (being bulky), compact to transport, functional during rainy or windy days, aesthetically attractive, among many others. I try to keep a balance between being technical and being entrepreneurial although I have to admit I am more of the former. When I was marketing my feeder before, I tried to price it at a margin lower than what most business people would do. But I realized soon that if I am to remain abreast with technology, I have to spend for R&D. This decision to be profit motivated allowed me to develop, with my own resources, three other fish feeder models, an automatic feed spreader, a motor-assisted Kinetic Feeder, and a solar-powered feeder. I have a nursery feeder coming out soon.

Shouldn't these views be shared by researchers?

Many colleagues I know see research work and entrepreneurial work to be conflicting. The reason probably is that science is exacting and transparent while business tends to be otherwise. As a result, many researchers intentionally leave the economic aspect of their

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27) of whales and dolphins in Philippine waters. Several species of marine animals have become endangered due to habitat destruction, exploitation for commerce, or hunting out of curiosity: giant clams (*Hippopus porcellanus, Tridacna gigas, T. derasa*), the sea cow *Dugong dugon,* the estuarine *Crocodylus porosus,* marine turtles (*Chelonia mydas, Eretmochelys imbricata, Lepidochelys olivacea, Dermochelys coriacea*), and sea snakes (*Hydrophis cyanocinctus, H. semperi, H. melanocephalus, H. ornatus, Laticauda colubrina, L. semifasciata, L. laticaudata, Pelamis platurus*).

The species count in the Philippines is far from complete. Several listings of terrestrial and marine flora and fauna have appeared in local science journals such as *Kalikasan,* the *Philippine Scientist,* and the *Papers of the National Museum.* Now more than ever, a comprehensive but rapid assessment of biodiversity is necessary before any more species go extinct.

The Philippines has enough laws to protect wildlife, both plants and animals, but these laws have been difficult to enforce partly because of the low environmental awareness of the general public. Angel Alcala recommends three wildlife conservation measures: (i) intensive conservation education at all school levels and of all sectors of society, (ii) establishment of more nature parks and wildlife reserves, and (iii) establishment of breeding centers for endangered wildlife. The following articles in this series will describe the developments in non-formal conservation education, and in nature parks and wildlife breeding centers in the Philippines.

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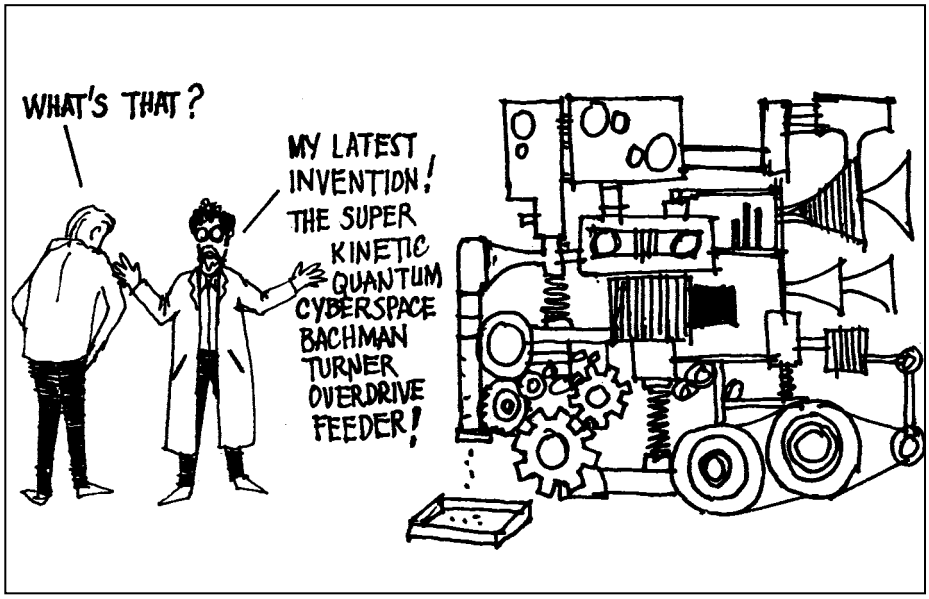
work for entrepreneurs to pursue. Many results, however, look ideal in the laboratory but are not realistic in the field. That is the sad part. And we thought we did a good job already. Take for example making low cost farm-made feeds. The seasonal availability of many raw materials actually make backyard feedmilling uneconomical during lean supply months when big commercial feed millers corner the supply. As a backyard feedmiller you buy your raw materials at the retail level which is not only more costly but must be paid in cash. Furthermore, rudimentary feed pelleting equipments produce feed pellets that have poor water stability. This leads to poor growth due to significant nutrient losses and water pollution. Thus, in actual field conditions, at least in the Philippines, making farm-made feeds is not economically viable. Research work I believe should be conceptualized and carried out up to the commercial scale where our ultimate goal of food production is realized. It is actually more challenging and fulfilling this way.

How do you view the progress of aquaculture technology generation in the country?

There is a lot of research being done but unfortunately there is little that end up in commercial use. I believe researchers should try to be more involved with the industry even if they do not share the same view with entrepreneurs. It was widely known in the scientific community that intensive shrimp farming is not going to be sustainable so many distanced themselves from conducting research in these activities. When the the industry was eventually hit by disease problems, there was little that could be done by researchers



since little was understood of the culture practices. It is only now that institutional effort is being made to save the shrimp industry but it is already quite late. High density milkfish culture is the new craze and this can very well follow the footsteps of the shrimp industry. I think by being abreast with industry, scientists are in a better position to detect early on production problems before these happen. If problems do indeed happen, rehabilitation at least will be easier. Whether we like it or not, entrepreneurs will invest where there is money. They will try to generate technology on their own if this is not available and this is not a good idea.

What do you think is the future direction of our aquaculture industry? Does the shrimp industry have a chance of being rehabilitated?

I think more and more aquaculture activities is going to be directed to marine cage and pen farming where there is large area available for expansion. We see this now for milkfish culture in Pangasinan, Davao, Leyte, Cebu, Iloilo, and Negros. Cage and pen farming is much more productive than pond culture and there is no need to spend for pumping or aeration. It is very attractive to investors. As for the shrimp industry, if the disease problems are controlled, there are still many farmers in Negros and other parts of the country that would want to come back. I am not so optimistic however because the intensification of milkfish is going to lower water quality in the coming years.

What are your plans?

I am focusing attention on cage farming. I am now experimenting on culture methodologies and all-weather cage facilities. Of course this will include the use of automatic feeders. There is much R&D I'd like to do and intend to do. My approach is not to reinvent the wheel but to adopt existing technologies to suit local farming needs and conditions, much like what I did with the Kinetic Feeder.

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tein and energy per body weight than adults having higher growth rate. Also, small juveniles may require a different amino acid balance because of different growth requirement as viscera and physiological processes develop. Adults may require more lipid in the diet during gonad development. Bacterial growth which develop in the surface of the feed during prolonged storage may even improve the feed's nutritional quality. Viable bacteria in the gut of juveniles may also contribute significant quantities of nutrients to the diet and could perform metabolic activities in the gut that are highly significant to the abalone's development. Strains of these bacteria are capable of hydrolysing a variety of complex polysaccharides in algae.

Artificial diet enhances growth of hatchery-stage juveniles. It can improve survival and can aid in broodstock management. Artificial diets can be cost-effective since these improve productivity.

Nutritional value of ingredients

The best way to establish the nutritional value of ingredients for use in artificial diets for abalone is to determine the availability of the nutrients within the ingredients, i.e. the proportion of nutrients capable of being used by the abalone.

Digestive enzymes and the digestive capacity of abalone

The digestive enzymes of abalone can be purchased commercially. These are used extensively to lyse cell walls so that the protoplasts can be extracted for experimental use. Proteolytic activity of *Haliotis discus* was most active in an acidic environment. The carbohydrases have been investigated for abalone species. The abundant and com-

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